HUMAN CAPITAL EXTERNALITIES AND PRIVATE RETURNS TO EDUCATION IN KENYA

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INTRODUCTION

At the time of Kenya's independence in 1963, shortage of skilled labor was a major constraint to the achievement of the nation's development goals. To improve this situation the Kenyan government has consistently devoted a large share of its budget to education expansion. For instance, the education sector share of total government budget in 1998 was 29 percent, one of the highest in Africa. The share of government spending on education increased even more in 2003 following the introduction of free primary education by the newly elected government. In the earlier decades after independence, most of the expansion took place at the primary and secondary education levels.[1] With time and especially since the late 1980s, there has also been a rapid expansion in the number of public and private universities. Student enrolments in primary and secondary schools increased from 0.9 and 0.03 million in 1963 to 7.1 and 0.9 million in 2003, respectively. The number of primary and secondary schools also increased from 6,058 and 150 in 1963 to about 19,496 and 3,999 in 2003, respectively. The number of schools may, however, understate the extent of expansion in the education system since within the existing schools, expansion was in form of increased number of classes. At the primary level, the expansion was partly due to rapid increase in the population and also government commitment to fight ignorance, while at the secondary level, the increase was due to the large number of schools, built through self-help initiatives in response to the high demand for secondary education.[2]

Given the large amounts of resources devoted to education by both government and parents, it is fitting to investigate whether the education system yields returns to individuals that justify the resources invested in schooling. Estimates of returns to education conventionally measure the benefits of education in the form of higher wages. Private rates of return to education include only private benefits and costs,

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while social rates of return to education differ from the private returns because of the inclusion of direct costs of education by society as well as the ensuing societal benefits such as the higher tax revenues.

In terms of policy making, returns to education are useful in a number of ways. For instance, social returns are useful because they provide an indication of which sector of the education system the government should invest in. If there are significant differences in returns to primary and secondary education, for example, this is a signal to policy makers and households to invest relatively more in the education level that yields higher returns.

An analysis of returns to education can also help in the evaluation of broad education policies. It is, for example, well established that human capital is crucial to economic development [Ranis, Stewart and Ramirez, 2000]. Governments should therefore seek to adopt policies that are consistent with human capital development. To the extent that returns to education in a particular country may show a declining trend, it is necessary to evaluate the causes of such decline. On the one hand, declining returns may influence private choices on education as evidenced by high drop-out rates and low enrolments in Kenya prior to the introduction of free education at the primary level. On the other hand, it could be that government policies themselves are responsible for the decline in enrolment. For example, it has been shown that the policy of cost-sharing in education in Kenya has had a negative impact on primary school enrolments [Bedi *et al*. 2004]. Further, households evaluate benefits of schooling decisions in terms of the expected future earnings. If these benefits are too low, then policies that promote education as an element of the poverty alleviation strategy may be ill-conceived. Alternatively, if the returns associated with education are high but school enrolments are low, it is an indication that individuals are not investing optimally in education, perhaps due to market failure. Thus, a study on returns to education has important policy implications.

A large number of studies from various parts of the world show that returns for an additional year of schooling are positive and range anywhere from 5 percent in developed countries to 29 percent in developing countries [Psacharopoulos, 1985; 1994]. In a 1994 survey, Psacharopoulos [1994], finds that returns to education in Africa are higher than for other regions. This finding has generated debate about whether the reported estimated rates of return prevail for some African countries given the existing labour market conditions. For instance, Bennell [1996] suggests that the findings by Psacharopoulos [1994] for Africa are heavily influenced by a few dated studies some of which were based on poor data. Besides, estimates of returns to schooling in Africa since the 1980s have been moderate [Appleton, 1999]. Given the inconclusiveness of these studies, more accurate estimates of returns to education are needed for purposes of informing policy makers. There is need, therefore, to estimate refined returns to education based on recent and more comprehensive data. Such an exercise is important because rates of return to education in Kenya have been shown to vary over time [Appleton, Bigsten and Manda, 1999; Manda, 1997] and therefore estimates based on dated data may not properly inform policy today.

When estimating private returns to education, it is normally assumed that returns to an individual are independent of the education human capital endowments of

others[3] This assumption, which dominates most of the previous studies, ignores a major aspect of human capital theory - namely human capital externalities. Existence of human capital externalities suggests that increasing the education human capital of one person will have some impact not only on the earnings of that individual but also on earnings of other individuals [Schultz, 2004; Weir and Knight, 2004].

In a competitive economy, where workers are paid the value of their marginal product, increasing the average human capital induces an increase in the demand for skilled labor (the demand effect). Similarly, a direct consequence of a larger share of the population that is educated is to increase the supply of skilled labor. *Ceteris paribus*, such an increase in demand would result in higher earnings. On the other hand, the increase in supply of skilled labor would, other things being equal, have the effect of lowering earnings [Mwabu and Schultz, 1996]. The net effect on earnings is positive (negative) when human capital externalities are such that the demand (supply) effect dominates the supply (demand) effect [Michaud and Vencatachellum, 2003]. Failure to control for human capital externalities in the earnings equation can therefore lead to biased estimates of the parameters of the earnings function.

An interesting extension of the idea of human capital externalities concerns the impact of male (female) education on the earnings for women (men). If in fact it is the case that there are significant positive female human capital externalities on, for example, male earnings, then the limited emphasis on women's education in Africa could actually have the effect of lowering the earnings of men. On the other hand, providing education opportunities to both men and women has salutary effects on overall earnings.

A number of studies have previously analyzed returns to education in Kenya [*e.g.*, Bigsten, 1984; Knight and Sabot, 1990; Knight, Sabot and Hovey, 1992; Manda, 1997; Appleton, Bigsten and Manda, 1999]. This paper builds on these studies and estimates private returns to education using a comprehensive micro dataset of full-time workers collected by the Government of Kenya in 1994. In addition to estimating the private returns to education, the paper focuses on effects of human capital externalities on earnings.

DATA AND METHODS

We use data from the Welfare Monitoring Survey (WMS) of 1994 undertaken by the Central Bureau of Statistics (Ministry of Finance and Planning, Government of Kenya). The primary purpose of the survey was to collect data that would assist the government to assess the status of the welfare of the population. The survey covered all the eight provinces in Kenya and gathered information from each district on employment status, health, fertility, household size, marital status, education, crops and livestock, household incomes and expenditure on various items, children's nutrition, and social amenities. We supplement this information in the survey with district level measures of education for males and females (proxies for average human capital at the district level). These proxies facilitate estimation of human capital externalities at the household level, and may be contrasted with site- and village-level proxies used by Weir and Knight [2004] in their Ethiopian study. The WMS of 1994 provides informa-

tion on individual earnings, education and age, which are useful in the estimation of returns to education. The sample used in our study includes only individuals in the working age group 15 to 65 years and who are full-time employees. The sample size used consists of 6,140 observations covering individuals both in the rural (4,878) and urban (1,262) areas.

TABLE 1
Definition of Variables

Variable	Definition
Monthly earnings	*Natural logarithm of monthly earnings*
No education	1 if an individual has no formal education, 0 otherwise
Incomplete primary education	1 if an individual joined but did not complete primary education, 0 otherwise
Completed primary education	1 if an individual completed primary education, 0 otherwise
Incomplete secondary education	1 if an individual joined but didn't complete secondary education, 0 otherwise
Completed secondary education	1 if an individual completed four years of secondary education, 0 otherwise
University education	1 if an individual has university education, 0 otherwise
Potential experience	Number of years an individual has been working
Potential experience squared	The square of the number of years an individual has been working
Urban	1 if an individual lives in the urban area, 0 otherwise
Rural	1 if an individual lives in the rural area, 0 otherwise
Nairobi	1 if an individual lives in Nairobi Province, 0 otherwise
Coast	1 if an individual lives in Coast Province, 0 otherwise
Rift Valley	1 if an individual lives in Rift Valley Province, 0 otherwise
Western	1 if an individual lives in Western Province, 0 otherwise
Eastern	1 if an individual lives in Eastern Province, 0 otherwise
North Eastern	1 if an individual lives in North Eastern Province, 0 otherwise
Nyanza	1 if an individual lives in Nyanza Province, 0 otherwise
Central	1 if an individual lives in Central Province, 0 otherwise
Male	1 if an individual is male, 0 otherwise
Female	1 if an individual is female, 0 otherwise
Pupil/trained teacher ratio	The number of students per trained teacher in primary school
District average education for males (years)	District average years of education for men
District average education for females (years)	District average years of education for women

A worker's specific human capital is approximated by the *highest education level attained and by years of potential experience*. We define a worker's potential experience as his age minus six years, and minus the number of years of schooling.[4] We further estimate the effect of education on earnings by using dummy variables to represent levels of schooling of workers. *Average years of education in a district* (for males and females) are used as a proxy for average human capital of workers. Using this variable to estimate human capital externality (effect of the average education of all workers on earnings of a given worker) could be criticised on the grounds that it may be a proxy for other things such as the quality of education or different labour market conditions in various districts. To control for quality effects, we use *pupil-trained teacher ratio for primary schools* as a proxy for quality of education. A high

pupil-trained teacher ratio indicates low quality of education and vice versa. Since people do not necessarily work in districts where they went to school, the variable may not capture differences in public education investments or variations in regional quality of education. However, it is possible that if quality education exists in a particular district (especially in primary schools), it could attract people to work in such a district.

In general, differences in labor market conditions exist between rural and urban areas and between public and private sector. We control for these differences by including *regional dummies* in the earnings equation. Further, since we use data on full-time employees only, this reduces the heterogeneity problem because there isn't much difference among these employees in rural and urban areas and between public and private sector.[5] Other control variables in this respect include *regional dummies*. All the variables used in the analysis are defined in Table 1 and the descriptive statistics are presented in Table 2.

TABLE 2
Descriptive Statistics-Mean

Variable	National	Urban	Rural	Males	Females
Mean monthly earnings	3192.2	4163.1	2940	3593.3	1960.56
	(5829.1)	(7875)	(5137.7)	(6427)	(3076.5)
No education	0.16	0.11	0.18	0.14	0.23
Incomplete primary education	0.28	0.2	0.3	0.29	0.26
Complete primary education	0.17	0.14	0.17	0.18	0.14
Incomplete secondary education	0.15	0.19	0.14	0.15	0.15
Complete secondary education	0.18	0.26	0.16	0.19	0.15
College education	0.04	0.0.06	0.04	0.03	0.06
University education	0.02	0.04	0.01	0.02	0.01
Potential experience	19.32	17.35	19.83	20.8	14.77
	(9.96)	(9.18)	(10.1)	(9.75)	(9.19)
Potential experience squared	472.52	385.19	495.21	527.85	302.65
	(416.7)	(368)	(425.6)	(425.4)	(336.2)
Urban	0.21	-	-	0.17	0.31
Rural	0.79	-	-	0.83	0.69
Nairobi	0.03	0.13	-	0.02	0.04
Coast	0.1	0.14	0.09	0.1	0.1
Rift Valley	0.24	0.21	0.25	0.24	0.26
Western	0.09	0.09	0.09	0.1	0.07
Eastern	0.18	0.16	0.19	0.18	0.2
North Eastern	0.02	0.03	0.02	0.02	0.02
Nyanza	0.14	0.17	0.14	0.15	0.13
Central	0.19	0.07	0.23	0.2	0.18
District average education for males	7.32	8.13	7.74	7.82	7.81
(years)	(1.33)	(1.44)	(1.28)	(1.32)	(1.37)
District average education for females	7.82	7.56	7.26	7.32	7.33
(years)	(1.82)	(1.81)	(1.82)	(1.82)	(1.82)
Pupil trained teacher ratio	36.8	37.02	36.81	36.91	36.67
	(8.55)	(8.26)	(8.62)	(8.58)	(8.44)
Proportion of Males	0.75	0.63	0.79	-	-
Proportion of Females	0.25	0.73	0.21	-	-
Sample Size	6140	1262	4878	4655	1485

The Model

We follow Mincer [1974] in estimating a semi-logarithmic equation for the determinants of earnings, specified as follows:

$$\ln(W_i) = \alpha + \sum \beta_k S_{ki} + \lambda A_i + \delta Z_i + U_i \tag{1}$$

where W_i is *monthly earnings for worker i*; S_k are dummy variables representing the *highest level of schooling attained by a worker*; A is *potential experience*; Z is a vector of control variables such as *sex, regional dummy variables*, including proxies for *average human capital* and U is an error term. It would have been more appropriate to use hourly earnings, but information on hours of work was not available in the data set. To reduce the error in monthly earnings due to variations in hours worked by full-time and non full-time employees, we make use of data on full-time employees only.

Our main interest in estimating equation (1) is to calculate the private rate of return to education. Estimates of private returns to education conventionally measure the benefits of education in the form of higher wages. From equation (1), the rate of return to a given level of education is derived as shown in equation (2).

$$\text{Rate of return of education} = \frac{\exp(\beta_h - \beta_l) - 1}{E_h - E_l} \tag{2}$$

Where β_h is the estimated coefficient of a higher level of education (*e.g.*, a dummy for completed secondary education); β_l is the estimated coefficient of a lower level of schooling (e.g., a dummy for completed primary education); E_h is the total number of years taken to attain a particular level of higher education; and E_l is the total number of years spent schooling at a lower level of the education system. For instance, to calculate the return to secondary education, E_h will be 12 years (*i.e.*, eight years of primary schooling plus four years of secondary education); and E_l will be 8 years (*i.e.*, eight years of primary education) so that $(E_h - E_l) = 4$ years. More generally, equation (2) computes the rate of return for a year of schooling at any level of the education system. For example, if everyone has primary education, and the highest education attainment at that level is 5 years, the lower level of education is necessarily 4 years so that $(E_h - E_l) = 1$. If $(E_h - E_l) = 0$, it means that there is no investment in higher education and therefore the rate of return to education is undefined.

Estimation Issues

Estimates of returns to education may suffer from several drawbacks. These include omission of relevant variables and endogeneity of schooling. Although several approaches to these problems have been developed, this study does not fully benefit from them due to data limitations.

Omitted Variables: Omission of unobserved characteristics such as ability can bias conventional OLS estimates [see Blackburn and Neumark, 1995]. Including ability proxies tends to lower the estimated returns to schooling indicating that OLS estimates are biased upwards. Other studies [*e.g.*, Ashenfelter and Krueger, 1994; Ashenfelter and Zimmerman, 1993; Taubman, 1976] have used panel data for twins to estimate returns to schooling. The idea behind this approach is that differencing eliminates the effects of common ability and family-background so that the estimates are purged of these time-invariant effects. Studies using this approach display varying results, with some reporting slightly lower and others reporting slightly higher educational return estimates as compared to conventional OLS estimates. Using data on workers in Kenyan and Tanzanian urban enterprises, Knight and Sabot [1990] test whether human capital (measured as cognitive skill) has an independent effect on earnings or if it simply signals inborn ability (measured by ability test scores). They find that, though ability might have a role in wage formation, controlling for it does not diminish the effect of human capital on earnings.

OLS estimates of the effect of education on earnings are consistent only if, for example, unobserved variables are not correlated with both education and earnings. However, if an unobserved characteristic, say 'ability' has a positive effect on earnings and schooling, then OLS estimates of the returns to schooling will be biased upwards. Another source of bias is measurement error in schooling. This may generate a negative correlation between the earnings and schooling equation error terms and induce a negative bias in OLS estimates [see Griliches, 1977; Blackburn and Neumark, 1995].

A negative bias could also arise if workers with low schooling have a higher earnings capacity (and higher returns to schooling), but curtailed their education due to higher discount rates. This negative correlation is implied in the Becker model of human capital investment in which schooling is acquired until the marginal return to schooling equates the discount rate [Card, 1995].

Other studies find that family background such as parent's education and income (another commonly omitted set of characteristics) has a positive impact on wages and that returns to education decline when family background variables are included in the earnings regressions [*e.g.*, Wambugu, 2003]. Armitage and Sabot [1987] examined how parental education interacted with employees' earnings in establishments located in Nairobi, Kenya and Dar es Salaam, Tanzania. They find that the private return to secondary education increased monotonically with parental education. Wambugu [2003] using data on Kenyan manufacturing firm employees, finds that controlling for parental education in the earnings function reduces the level of returns to workers education only by a small percentage.

The data set used in this study does not provide information that can be employed to control for ability, family background, or personal discount rates. Also, as is the case in most developing countries, panel data of workers in Kenya is not available. However, we make the assumption that though unobserved ability might have a role in wage formation, it does not significantly diminish the effect of human capital on earnings [*e.g.*, Knight and Sabot, 1981, 1990]. In this study it is not possible to control for unobserved ability or eliminate its effect using panel data. This may bias our OLS estimates upwards. However, we use pupil-trained teacher ratio for primary schools

as a proxy for quality of education at the district level, and thus at least mitigate the bias due to omission of this variable from the estimating equation.

Endogeneity of Schooling: In estimating returns to education, it is assumed that investment in schooling is independent of earnings. In other words, schooling is exogenous to earnings. However, if an individual takes into account expected earnings in making the decision to investment in education, then that person's educational level is endogenous to earnings. Such endogeneity can bias OLS earnings estimates.

The schooling endogeneity problem can be taken into account by constructing a 'selectivity-correction' term from a schooling attainment equation and then including the correction term in the earnings equation. Studies using this method typically report higher returns as compared to OLS estimates [*e.g.*, Gaston and Tenjo, 1992; Hansen, 1997]. An alternative way of solving schooling endogeneity relies on using exogenous (or 'natural') variation in educational attainment (such as differences in educational attainment across siblings) to provide instrumental variable (IV) estimates of returns to education. In this case, one has to look for variables that are strongly correlated with education but that do not directly influence earnings [Card, 1993; Angrist and Krueger, 1991; Harmon and Walker, 1995; Bedi and Gaston, 1999].[6] The main finding in these studies is that returns to education that take into account the potential endogenous nature of education often exceed standard estimates and the difference is large in some studies.

Unfortunately, information on variables that can be used in the analysis of schooling attainment function such as family background is not available, and we do not have any information on twins or siblings. We do not therefore attempt to control for endogeneity of schooling. This means that our estimates for returns to education based on OLS will be biased downward compared to results from studies that control for schooling endogeneity. However, results based on instrumental variable estimation may also be sensitive to the quality of variables used as instruments [Wambugu, 2003]. We do not expect the level of education attainment in Kenya to be determined by level of earnings because most students drop out of school as a result of poor performance in national examinations and lack of school fees.

RESULTS

The results are presented in full in Tables 3A to 3E. We report estimation results from equation (1) for national, urban, rural, males and females sub-samples.

Education, potential experience, sex and location dummy variables explain about 30 percent of the changes in log monthly earnings for all workers, 22 percent for males, and 34 percent for females at the national level. In the rural and urban areas, the variables explain between 26 and 42 percent of the variations in earnings as shown in Tables 3A to 3E. The coefficients for most of the independent variables are statistically significant and have the expected signs. The coefficient of *pupil–trained teacher ratio* is negative as expected, and statistically significant in most of the equations. Earnings are high in districts where quality of education is high (i.e., where the *pupil-trained teacher ratio* is low). Therefore the quality of education at the primary level in a given district has some positive impact on earnings in the region.

Wage Effects of Average Human Capital

As noted earlier, human capital externality is the effect on an individual's earnings of the education attainment of others. Human capital externality can be positive (when demand effect of average education on wages dominates the supply effect) or negative (when supply effect dominates the demand effect). In essence, ignoring the educational level of others in estimating returns to education could bias private returns to education. The size of this bias depends on the extent to which the productivity of a particular individual is influenced by education level of the co-workers. Firm-level data would be suited to evaluate human capital externalities. Absent such data, the alternative is to use average education attainment within the smallest jurisdiction for which data are available. For Kenya, the smallest jurisdiction for which data is available is the district.[7]

This paper uses *district-level average education attainment of workers* as the main control variable in estimating private returns to education. That is, we control for human capital externalities in computing these returns. Since the male and female average human capital variables are highly correlated, we investigate their effects by including them in separate equations. At the national level, the female average human capital has a positive, statistically significant effect on earnings of workers while the average male human capital has a positive but insignificant effect. The estimates show that an increase in average human capital for females has a positive impact on earnings of all workers. At the national level, men benefit more from the increase of female human capital than from the accumulation of their own human capital. In the rural areas male district level human capital has a negative and significant effect on earnings while female human capital has a positive but insignificant effect.[8]

The effect of *district level average education for males and females* on earnings is positive and statistically significant for all workers in the urban areas. This suggests that in the urban areas, the supply effect of skill accumulation on wages does not dominate the demand effect. For instance, an increase in the supply of skilled men and women is accompanied by an increase in the demand for their respective labor services in such a way that the positive demand effect on wages exceeds the negative supply effect, leading to a net increase in earnings. Consequently, increasing the proportion of workers who are educated has two effects on returns to education. First, as explained in Mwabu and Schultz [2000], the marginal return to education falls as more people are educated so that the new earnings function is flatter. Second, the returns to earnings function shifts upwards such that for a given level of education, a worker earns more. We consider in greater detail the effect of human capital externalities on private returns to education in the next subsection. Our results find support in Griliches' [1977] work as well as in the endogenous growth literature [Barro and Sala-i-Martin, 1995].

Next, we consider the cross effects of male human capital on female earnings and vice-versa. At the national level, when the model is estimated on the sample of male workers, an increase in the average education of female labor force has a significant positive effect on male earnings. Also, when the model is estimated on a sample of females, an increase in the average education of males has a positive but insignificant

effect on female earnings. In the rural areas, the cross effect of average human capital on earnings is insignificant.

TABLE 3A
Estimated Earnings Coefficients for (All Workers and Male Sub-sample)

	All Workers			Male Workers		
Variables	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**
Constant	6.118**	6.309**	5.869**	6.587**	6.984**	6.352**
	(0.121)	(0.187)	(0.155)	(0.138)	(0.208)	(0.176)
Potential experience	0.093**	0.093**	0.094**	0.106**	0.106**	0.106**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Potential experience	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
Squared	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Incomplete Primary	0.195**	0.204**	0.176**	0.078	0.096	0.065
Dummy	(0.044)	(0.044)	(0.044)	(0.05)	(0.051)	(0.051)
Completed Primary	0.481**	0.496**	0.455**	0.286**	0.314**	0.268**
Dummy	(0.05)	(0.051)	(0.051)	(0.056)	(0.057)	(0.057)
Incomplete	0.750**	0.765**	0.728**	0.517**	0.547**	0.502**
secondary dummy	(0.052)	(0.053)	(0.053)	(0.059)	(0.06)	(0.059)
Completed	1.142**	1.154**	1.118**	0.899**	0.927**	0.883**
secondary	(0.051)	(0.052)	(0.052)	(0.058)	(0.059)	(0.058)
College dummy	1.767**	1.693**	1.646**	1.225**	1.261**	1.200**
	(0.077)	(0.078)	(0.078)	(0.091)	(0.092)	(0.092)
University dummy	1.702**	1.713**	1.688**	1.431**	1.451**	1.426**
	(0.113)	(0.113)	(0.113)	(0.116)	(0.116)	(0.116)
Pupil trained	-0.006**	-0.007**	-0.005**	-0.007	-0.008	-0.006
teacher ratio	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Male Dummy	0.586**	0.585**	0.589**			
	(0.033)	(0.033)	(0.033)			
Urban Dummy	0.181**	0.187**	0.172**	0.236**	0.247**	0.225**
	(0.036)	(0.036)	(0.036)	(0.042)	(0.016)	(0.042)
District Average		0.019			0.04	-
Education for Males		(0.014)			(0.016)	
District Average			0.026**			0.024**
Education for Females			(0.010)			(0.011)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Squared	0.3	0.3	0.3	0.22	0.22	0.22
No. of Observations	6140	6140	6140	4655	4655	4655

** significant at 1 percent level
* significant at 5 percent level
Standard Errors in Parentheses.

In the urban areas, when the model is estimated on the sample of male workers, an increase in the average education of female labor force has a significant positive effect on male earnings. Also, when the model is estimated on a sample of females, an increase in the education of males has a significant positive effect on female earnings. One explanation for this result is that, *ceteris paribus*, if male (female) workers education increases, the demand for female (male) workers increases. The increase in the demand for male workers may be due to the fact that when female human capital increases, it increases male productivity. Further, if female earnings increase, it must

TABLE 3B
Estimated Earnings Coefficients for Females Workers and Urban Workers

	Female Workers			Urban Workers		
Variables	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**
Constant	6.304**	5.733**	6.329**	5.887**	4.417**	4.968**
	(0.246)	(0.407)	(0.094)	(0.203)	(0.371)	(0.288)
Potential experience	0.088**)	(0.089**)	(0.088**)	(0.087**)	(0.085**)	(0.085**)
	(0.01)	(0.01)	(0.01)	(0.011)	(0.024)	(0.01)
Potential experience	-0.002**	-0.002**	-0.002**	-0.001**	-0.001**	-0.001**
Squared	(0.0003)	(0.0001)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Incomplete Primary	0.199**	0.161*	0.199**	0.285**	0.137	0.146
Dummy	(0.094)	(0.092)	(0.094)	(0.116)	(0.119)	(0.119)
Completed Primary	0.722**	0.667**	0.727**	0.555**	0.381**	0.387**
Dummy	(0.107)	(0.112)	(0.113)	(0.126)	(0.131)	(0.131)
Incomplete secondary	1.146**	1.100**	1.150**	0.982**	0.819**	0.857**
dummy	(0.106)	(0.11)	(0.111)	(0.121)	(0.125)	(0.123)
Completed secondary	1.620**	1.528**	1.624**	1.421**	1.260**	1.263*
	(0.108)	(0.11)	(0.115)	(0.119)	(0.123)	(0.123)
College dummy	2.442**	2.390**	2.447**	2.001**	1.797**	1.8
	(0.145)	(0.147)	(0.149)	(0.159)	(0.164)	(0.164)
University dummy	2.676**	2.628**	2.680**	2.120**	2.003**	2.021**
	(0.374)	(0.375)	(0.376)	(0.184)	(0.185)	(0.184)
Pupil trained	-0.007	-0.005	-0.007	-0.001	0.001	0.002
teacher ratio	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Male Dummy				0.47	0.486	0.481
				(0.066)	(0.066)	(0.066)
Urban Dummy	0.092**	0.072**	0.093			
	(0.07)	(0.071)	(0.07)			
District Averages		0.059**			0.158**	
Education for Male		(0.034)			(0.034)	
District Average			-0.003			0.109**
Education for Females			(0.069)			(0.024)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Squared	0.34	0.34	0.34	0.41	0.42	0.42
No. of Observations	1485	1485	1485	1262	1262	1262

** significant at 1 percent level
* significant at 5 percent level
Standard Errors in Parentheses.

be due to the demand effect originating from male human capital, which increases female productivity. Thus, it appears that education levels of males and females reinforce each other in the urban labor market thereby raising productivity and wages of both sexes. Thus policies or social norms that restrict education opportunities of one group have three deleterious effects. First, such policies or norms lower the earnings of the disadvantaged group. Second, since the positive externalities that would have arisen from human capital accumulation of the disadvantaged group are stifled, the full labor market productivity of the favored group is never attained. Finally, discriminatory policies have the undesirable effect of lowering average earnings and the welfare of the two groups. Thus, equitable public and private investment in male and female education is justified on Pareto efficiency grounds.

TABLE 3C
Estimated Earnings Coefficients for Rural Workers and Urban Male Workers

	Rural Workers			Urban Male Workers		
Variables	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**
Constant	5.973**	6.358**	5.885**	5.388**	5.388**	5.510**
	(0.103)	(0.155)	(0.128)	(0.149)	(0.378)	(0.318)
Potential experience	0.093**	0.092**	0.093**	0.103**	0.102**	0.099**
	(0.005)	(0.005)	(0.005)	(0.013)	(0.013)	(0.013)
Potential experience Squared	-0.002**	-0.002**	-0.002**	-0.001**	-0.001**	-0.001**
	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0003)	(0.0003)
Incomplete Primary Dummy	0.202**	0.222**	0.194**	0.187	0.111	0.078
	(0.048)	(0.048)	(0.048)	(0.148)	(0.154)	(0.151)
Completed Primary Dummy	0.486**	0.522**	0.475**	0.399**	0.309	0.269**
	(0.054)	(0.055)	(0.055)	(0.156)	(0.163)	(0.161)
Incomplete secondary dummy	0.729**	0.766**	0.718**	0.685**	0.600**	0.591**
	(0.058	(0.059)	(0.059)	(0.154)	(0.16)	(0.156)
Completed secondary	1.096**	1.129**	1.086**	1.104**	1.019**	0.986**
	(0.057)	(0.058)	(0.058)	(0.148)	(0.155)	(0.152)
College dummy	1.609**	1.650**	1.597**	1.535**	1.437**	1.386**
	(0.089)	(0.09)	(0.09)	(0.215)	(0.216)	(0.219)
University dummy	1.450**	1.483**	1.446**	1.757**	1.698**	1.686**
	(0.152)	(0.152)	(0.152)	(0.199)	(0.202)	(0.199)
Pupil trained teacher ratio	-0.008**	-0.009**	-0.007**	-0.006	-0.005	-0.003
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
Male Dummy	0.595**	0.594**	0.5929**			
	(0.038)	(0.038)	(0.019)			
District Average Education for Males		-0.054**			0.072**	
		(0.016)			(0.038)	
District Average Education for Females			0.013			0.086**
			(0.011)			(0.027)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Squared	0.26	0.27	0.26	0.28	0.28	0.28
No. of Observations	4878	4878	4878	801	801	801

** significant at 1 percent level
* significant at 5 percent level
Standard Errors in Parentheses.

Returns to Own Education

Table 4 shows private returns to education at the national level and by region and gender before taking into account human capital externalities. The private returns to education generally increase with the level of education. At the national level, the rate of return to primary education is 7.7 percent, 23.4 percent for secondary education and 25.1 percent for university education. Returns to education in the urban areas are higher than returns to education in the rural areas. Thus, it is more beneficial for those with formal education to work in the urban areas than in rural areas. In the rural areas, returns to university education are lower than returns to secondary education, an indication that university graduates are worse-off working in the rural

than in the urban areas. Those individuals with secondary education do not lose as much as those with university education when employed in the rural areas. In general private returns to college education are lower than returns to secondary and university education in the urban areas, but higher than returns to secondary and university education in the rural areas.

TABLE 3D
Estimated Earnings Coefficients for Urban Female and Rural Male Workers

	Urban Female Workers			Rural Male Workers		
Variables	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**	**Coefficients**
Constant	6.330**	3.078**	4.781**	6.318**	6.646**	6.181**
	(0.374)	(0.099)	(0.513)	(0.184)	(0.218)	(0.204)
Potential experience	0.084**	0.080**	0.086**	0.105**	0.105**	0.106**
	(0.018)	(0.018)	(0.018)	(0.006)	(0.006)	(0.006)
Potential experience Squared	-0.001**	-0.001**	-0.001**	-0.002**	-0.002**	-0.002**
	(0.0006)	(0.0005)	(0.0005)	(0.0001)	(0.0001)	(0.0001)
Incomplete Primary Dummy	-0.009	-0.332	-0.277	0.088	0.107*	0.08
	(0.195)	(0.196)	(0.201)	(0.053)	(0.054)	(0.054)
Completed Primary Dummy	0.408**	0.051**	0.106**	0.288**	0.319**	0.277**
	(0.219)	(0.22)	(0.227)	(0.061)	(0.062)	(0.061)
Incomplete secondary dummy	1.048**	0.716**	0.806**	0.522**	0.557**	0.510**
	(0.203)	(0.203)	(0.207)	(0.065)	(0.066)	(0.066)
Completed secondary	1.586**	1.297**	1.290*	0.882**	0.913**	0.872**
	(0.211)	(0.209)	(0.218)	(0.064)	(0.064)	(0.064)
College dummy	2.195**	1.736**	1.806	1.200**	1.240**	1.182
	(0.246)	(0.249)	(0.258)	(0.101)	(0.102)	(0.151)
University dummy	2.677**	2.333**	2.400**	1.290**	1.319**	1.290**
	(0.443)	(0.43)	(0.439)	(0.151)	(0.151)	(0.006)
Pupil trained teacher ratio	-0.002	0.0002	-0.0005	-0.007**	-0.009**	-0.006**
	(0.008)	(0.008)	(0.008)	(0.002)	(0.002)	(0.002)
District Average Education for Males		0.362**			-0.049**	
		(0.061)			(0.017)	
District Average Education for Females			0.205**			0.019
			(0.048)			(0.012)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Squared	0.43	0.47	0.45	0.2	0.2	0.2
No. of Observations	461	461	461	3854	3854	3854

** significant at 1 percent level
* significant at 5 percent level
Standard Errors in Parentheses.

Returns to education in the urban areas compare very well with those of previous studies [*e.g.*, Appleton, Bigsten and Manda, 1999; Manda, 1997].[9] It is important to note however, that our estimates of returns to education for urban areas are greater that those estimated by Wambugu [2003] for the same period. We can nevertheless among other things attribute this difference to differences in the data sets used in the two studies, as Wambugu's study uses data on employees in manufacturing firms only.

Table 3E
Estimated Earnings Coefficients for Rural Male Workers

		Rural Female Workers	
Variables	**Coefficients**	**Coefficients**	**Coefficients**
Constant	4.889**	5.562**	6.068**
	(0.281)	(0.486)	(0.411)
Potential experience	0.088**	0.088**	0.087**
	(0.012)	(0.012)	(0.012)
Potential experience Squared	-0.002**	-0.002**	-0.002**
	(0.0003)	(0.0003)	(0.0003)
Incomplete Primary Dummy	0.232**	0.260**	0.279**
	(0.103)	(0.105)	(0.106)
Completed Primary Dummy	0.825**	0.885**	0.901**
	(0.125)	(0.03)	(0.031)
Incomplete secondary dummy	1.117**	1.159**	1.182**
	(0.132)	(0.13)	(0.135)
Completed secondary	1.619**	1.654**	1.694**
	(0.132)	(0.133)	(0.137)
College dummy	2.554**	2.59	2.614
	(0.193)	(0.194)	(0.195)
University dummy	2.062**	2.143**	2.195**
	(0.798)	(0.799)	(0.799)
Pupil trained teacher ratio	-0.007	0.009**	-0.010**
	(0.004)	(0.004)	(0.004)
District Average Education for Males		-0.071	
		(0.042)	
District Average Education for Females			-0.054
			(0.028)
Provincial dummies	Yes	Yes	Yes
Adj. R-Squared	0.29	0.29	0.29
No. of Observations	1024	1024	1024

** significant at 1 percent level
* significant at 5 percent level
Standard Errors in Parentheses.

Although our estimates of private returns to education may deviate from the true rates of return (due to estimation biases considered in section on Estimation Issues), they serve as a baseline for comparing the rates of return in a specification that controls for educational externalities in the estimation of private returns to schooling.

The returns to education for females are relatively higher than the returns to education for males both at the national and regional level. At the primary education level, the returns to primary education for females are about triple the returns for males at the national and for rural areas. In the urban areas, returns to primary education for men and women are similar. At the national level, returns to college and university education are much higher for women than for men. For instance, returns to women's college and university education are about triple that for men at the national level. Returns to college and university education are higher for women than for men in both rural and urban areas.

Generally, it is more beneficial for men with primary, secondary, college and university education to work in the urban areas than in the rural areas. On the other

TABLE 4
Private Returns to Education (Percentage)

	Completed Primary	Completed Secondary	College	University
National	7.7	23.4	23.6	25.1
Urban	9.3	34.4	26.2	34.8
Rural	7.8	21.0	22.4	14.2
All males	4.4	21.2	12.8	23.3
Urban males	6.1	25.6	17.9	30.7
Rural males	4.2	20.2	12.4	12.6
All females	13.2	36.3	43.5	62.5
Urban females	6.2	44.9	28.0	66.0
Rural females	16.0	30.3	51.5	18.6

hand it is advantageous for women with primary and college education to work in the rural areas while those with secondary and university education to work in the urban areas.

Tables 5 and 6 show returns to education after taking into account male and female human capital externalities respectively. First, taking into account the human capital externality generally reduces the estimated coefficients for the education dummies. However, the decline in the coefficients is not uniform across the education levels (see Tables 3A to 3E). The decline in the estimated coefficients at certain levels of education is much greater than for others. As a result, there are changes in the returns to schooling for certain levels of education.

As shown in the Tables 5 and 6, returns to education still increase with the level of education. The rate of return to university education increases while the rate of return to primary and college education declines when human capital externality is taken into account in the earnings equation. However, there is a negligible change in the returns to education in the rural areas, and on secondary education when human capital externality is taken into account. In most cases, the returns to primary education in the rural areas either increase by negligible amounts or remain about the same.

TABLE 5
Returns to Education Taking into Account Male Human Capital Externality (Percentage)

	Completed Primary	Completed Secondary	College	University
National	8.0	23.3	23.8	24.9
Urban	9.0	38.3	23.7	38.7
Rural	8.6	20.9	22.8	14.1
All males	4.6	21.1	13.2	23.0
Urban males	3.9	26.5	16.8	35.0
Rural males	4.7	20.3	12.9	16.7
All females	11.9	37.4	41.5	61.5
Urban females	0.7	61.9	18.4	60.6
Rural females	17.8	29.0	51.6	20.9

TABLE 6
Returns to Education Taking into Account Female Human Capital Externality (Percentage)

	Completed Primary	Completed Secondary	College	University
National	7.2	23.5	23.2	25.7
Urban	5.9	35.0	23.7	37.7
Rural	7.6	21.1	22.2	14.4
All males	3.8	21.3	12.4	24.0
Urban males	3.5	26.8	15.8	36.0
Rural males	4.0	20.3	12.1	18.8
All females	13.4	36.3	42.5	62.5
Urban females	1.4	56.7	22.5	67.8
Rural females	18.3	30.2	50.4	21.7

These results have several implications. First, previous studies on private returns to education especially in the urban areas by not taking into account human capital externalities overestimate private returns to primary and college education, and underestimate private returns to university education, especially in the urban areas. We follow the literature [see especially Schultz, 2004] in interpreting human capital externalities (social externalities of schooling) as the benefits to an individual derived from the schooling of other individuals. Controlling for human capital attainment of others therefore isolates these benefits from the usual measure of the rate of return to education to give a pure private return to education. In other words, holding constant the average schooling of other workers (Tables 5 and 6), the rate of return to a year of primary education is lower than the rate obtained when there is no control for the effect of average schooling in the earnings function for urban areas (Table 1). Similarly, controlling for the effect of the average years of schooling in an earnings equation raises the private rate of return to a year of university education above that estimated without this control (Table 4). Starting with the latter case, we explain these findings as follows.

Generally, an increase in the average level of schooling of all workers reduces the scarcity premium associated with university education. Consequently, when human capital of other workers is taken into account, we eliminate its negative effect on the scarcity premium received by a worker, and as a result, the private rate of return to university education increases (Tables 5 and 6). In contrast, private returns to primary education decline when control for human capital of others is included in the earnings regression (see Tables 5 and 6). This is because the beneficial effect of education of other workers is removed, leading to lower productivity for a typical individual with primary level of education. In this case, *human capital of others* enhances the productivity of a worker with primary education so that when its effect (positive social externality) is removed, the private rate of return falls.

Using imputed data on years of education derived from the information on levels of education provided in the datasets we estimated the following specification of the earnings equation:

$$\ln(W_i) = \alpha + \beta Y_i + \beta Y_i^2 + \lambda A_i + \delta Z_i + U_i \quad (3)$$

where Y is the imputed years of education and W, A and Z are as earlier defined in the text. The results are shown on Tables 7A, 7B and 7C. Comparison of returns to education at the national level, shows the private returns to education for secondary, college and university based on this specification are similar to those estimated based on equation (1) using education dummies. However, private returns to primary education using imputed years of education are higher than those based on primary education dummies. This is an indication that using primary education dummies may underestimate private returns to primary schooling. Using dummy variables for urban data only underestimates returns to primary education and overestimates returns to secondary and university education.

TABLE 7A
Private Returns to Education (Percentage) Using Imputed Years of Education

Sub-sample	Completed Primary	Completed Secondary	College	University
National	12.8	19.2	23.2	24.9
Urban	15.6	23.7	27.7	29.7
Rural	12.0	17.9	20.8	22.3
All males	10.4	13.0	21.0	22.8
Urban males	12.3	20.1	23.9	25.9
Rural males	10.0	16.4	19.7	21.3
All females	19.5	30.9	36.6	39.4
Urban females	19.6	33.5	40.4	43.9
Rural females	19.4	29.9	35.2	37.9

TABLE 7B
Private Returns to Education (Percentage) Using Imputed Years of Education and Taking into Account Male Human Capital Externality

Sub-sample	Completed Primary	Completed Secondary	College	University
National	12.8	19.7	23.2	24.9
Urban	14.9	24.6	29.4	31.8
Rural	12.0	17.9	20.8	22.2
All males	10.4	17.3	20.7	22.3
Urban males	12.0	20.6	24.8	27.0
Rural males	10.1	16.3	19.4	21.0
All females	18.9	31.5	37.8	40.9
Urban females	18.0	34.7	43.1	47.2
Rural females	19.0	30.2	36.0	38.9

TABLE 7C
Private Returns to Education (Percentage) Using Imputed Years of Education and Taking into Account Female Human Capital Externality

Sub-sample	Completed Primary	Completed Secondary	College	University
National	12.8	19.8	23.1	24.8
Urban	15.3	24.2	28.7	30.9
Rural	12.0	17.9	20.8	22.32
All males	10.5	17.4	20.7	22.4
Urban males	12.2	20.3	24.3	26.3
Rural males	10.0	16.4	19.5	21.1
All females	19.2	31.3	37.4	40.4
Urban females	18.6	34.7	42.7	46.8
Rural females	17.9	30.2	35.7	38.5

CONCLUSION

This study analyses returns to education and the associated wage effects of education of others (average human capital). The coefficient on the *average human capital* is our measure of the "social externality" of education (human capital externality). Several OLS regressions for the entire sample, and by gender and region are estimated. The results show that *human capital of others* has a positive effect on earnings of workers in the urban areas. Human capital externality is the benefit to an individual arising from education of others. At the national level, women's education has a significantly larger impact on male earnings compared to the impact that is associated with men's schooling on female earnings.

The private returns to education generally increase with the level of education. In the rural areas, private returns to university education are lower than returns to secondary and college education. This is in part due to the structure of labor markets. However, it is important to note that there are very few university graduates working in the rural areas as many migrate to urban areas where returns are much higher (see Table 4). Controlling for human capital externalities reduces private returns to primary education but increases returns to university education in the urban areas. However, human capital externalities are negligible at the secondary level of education. The decline in returns to primary education in urban areas when human capital externalities are taken into account reflects the decline in productivity of individuals with primary level of education when beneficial effects (positive social externalities) of education are removed. Similarly, the increase in private returns to university education, when controls for human capital externalities are included in the earnings equation reflects the increase in the scarcity premium of workers with university education when the negative supply effects of average human capital on earnings (negative social externalities of schooling for this group) are removed.

In general, the results of our analysis show that public policies that expand schooling opportunities for underprivileged social groups benefit the whole society via the externality effects of education. The benefits are in terms of improved productivity and earnings. Further, we have demonstrated that expansion of education opportuni-

ties may erode the wage premiums enjoyed by workers with higher education, thus reducing their private returns to schooling. The results seem to support free primary education since households are unlikely to invest in it because returns are low, yet it is a precondition for higher levels of schooling where returns are high. Since, the returns to college and university education are higher than for lower levels, they indicate that individuals would be willing to invest in higher education. However, since the returns come only after completing education at these levels of education, and given the fact that most Kenyans do not have resources to finance higher education, loans should be provided to those individuals who choose to pursue college and university education. Such loans should be extended especially to women since they are grossly under-represented in institutions of higher learning. The dominance of women's human capital externalities in earnings functions further justifies special support for women's education on efficiency grounds. However, considering the fact that Kenya's capital markets are under-developed, government role in extending or guaranteeing the loans is necessary.

NOTES

We are grateful to three anonymous referees and participants at the Southern Economic Association meetings for helpful comments. Special thanks to Julie Hotchkiss and the late Kenneth Koford for suggestions that helped improve the paper substantially.

1. The Structure of formal education in Kenya starts with eight years of primary education followed by four years of secondary education (high school). Transition from primary school to secondary school requires students to take a national examination - the Certificate of Primary Education. At the end of the four years of secondary education, students sit for another national examination-Kenya Certificate of Secondary Education. Depending on their qualifications, the secondary school graduates enroll for university education (typically four years) and others enroll in various types of colleges such as teacher training colleges, agricultural colleges, etc. Courses offered at these colleges typically take about two years.
2. Free primary education had been previously introduced in 1974 and resulted in a 40 percent increase in primary school enrolment. However, the introduction of cost sharing in education in the mid-1980s meant that parents were to spend more on textbooks, stationery, development fund, activity fees, examination fees and vacation tuitions fees, which partly led to a decline in primary school enrolment. The first decline in enrolment between 1984-85 may be attributed to the additional educational costs induced by the new educational structure and curriculum. Similarly, the second enrolment decline between 1989-90 also appears to be cost-driven and may be attributed to the re-introduction of school levies. This shows that in reality, primary education was not free. However, following the election pledges and the election of a new government in December 2002 general elections, primary education was made free 2003 and this has resulted in a big enrolment increase of about 1,500,000 additional students.
3. Following Schultz [1999] we distinguish between human capital associated with investments in health and nutrition (health human capital) from human capital formation by education (education human capital). Unless otherwise specified, we use the term human capital to mean education human capital.
4. This is based on the assumption that all individuals start schooling at age six. However, it is possible that some start school at an age earlier than six years. Also, we assume that individuals get employed immediately after completing school, which is a strong assumption, especially for women and youth who are underrepresented in the labor market.
5. Full-time workers include persons who work for all the hours of work and for all the working days as defined by the employer, except when on leave or otherwise officially away. This excludes self employed, part-time workers and casual workers. Part-time workers are employees who volun-

tarily work fewer hours than normal for an establishment. Casual workers are individuals who are engaged for a period not longer than 90 days and have no formal employment contract with the employer and their services can be terminated without notice. Our decision to use data on full-time employees is based on the fact that it helps eliminate the uncertainty associated with earnings for self employed, casual employees and also measurement errors in the earnings for these categories.

6. The other literature using instrumental variable approach to estimate returns to education include Uusitalo [1999] and Levin and Plug [1999] who use family background variables as instruments for education. Angrist and Krueger [1991] when estimating returns to education in the U.S use quarter of birth as an instrument. Harmon and Walker [1995] use change in minimum school leaving-age in the U.K and Card [1993] uses geographic proximity to college (the motivation being that if one is close to a college, the costs of attendance would be relatively lower and would acquire more education).
7. The geographical size of Kenya is similar to that of Texas in USA. The country is divided into eight administrative regions called Provinces. Each of the provinces is farther subdivided into smaller units called Districts. Districts are analogous to municipalities in the United States and they are fairly homogenous in terms of population and economic activities. In total there are 61 districts in Kenya.
8. The distinction between rural and urban is important. As in many developing countries, there are marked differences between rural and urban communities in terms of economic activities. In rural areas, the primary economic activity is agriculture and related processing industries. Urban areas on the other hand are dominated by services such as banking, insurance, hotels, medical government, industry and so on. Because of the structure of labor markets, human capital externalities can be expected to have different impact on earnings in rural and urban areas.
9. Note that comparison across studies even with data from the same country is not straightforward because of differences in data, time periods, specification of earnings functions and measurement errors. In this study we compare our private returns to education (see Table 4) with those of other studies based on data for the mid-1990s.

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